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(54) Communication systems for headgear

(57) This invention relates to a communication system for headgear, particularly helmets as used by motorcyclists or motor rally drivers.

A pair of helmets 1, 2 each have a microphone 3 in the inside of the chinguard and pairs of loudspeakers or headphones 4. An infra-red LED 5 and an infra-red photo-diode 6 are held in position by a trim garniture 7 which also contains the necessary other electronic devices and appropriate wiring so that the garniture can be sold as a unit for fitting to helmets.

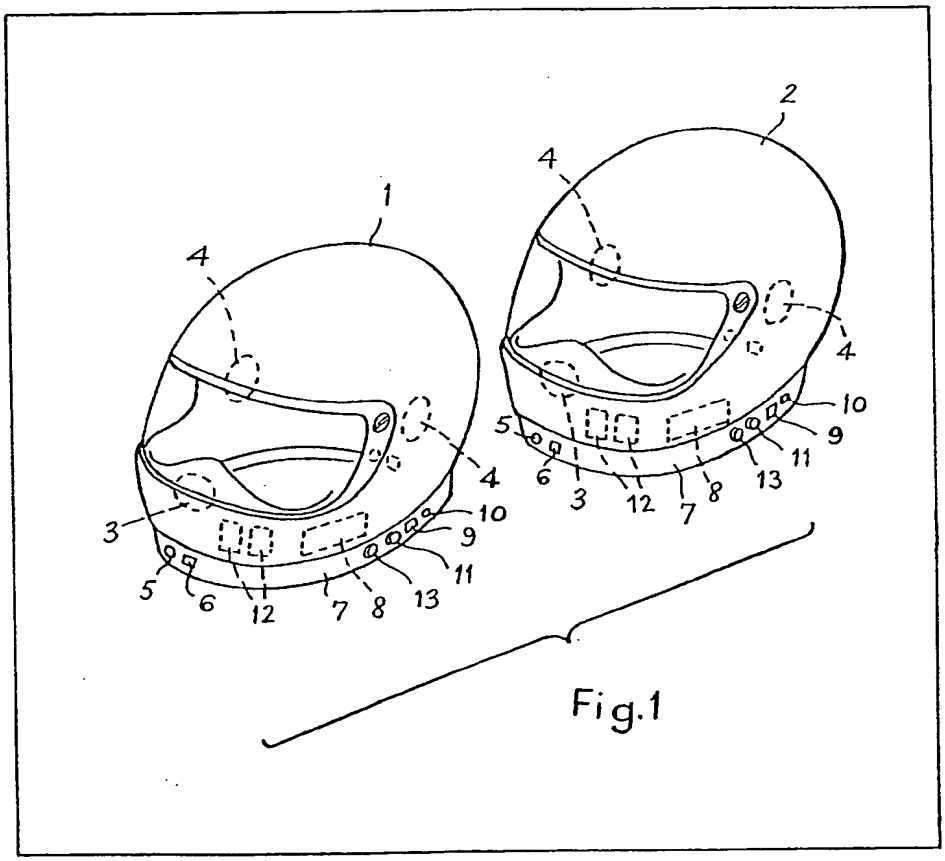

Fig.1

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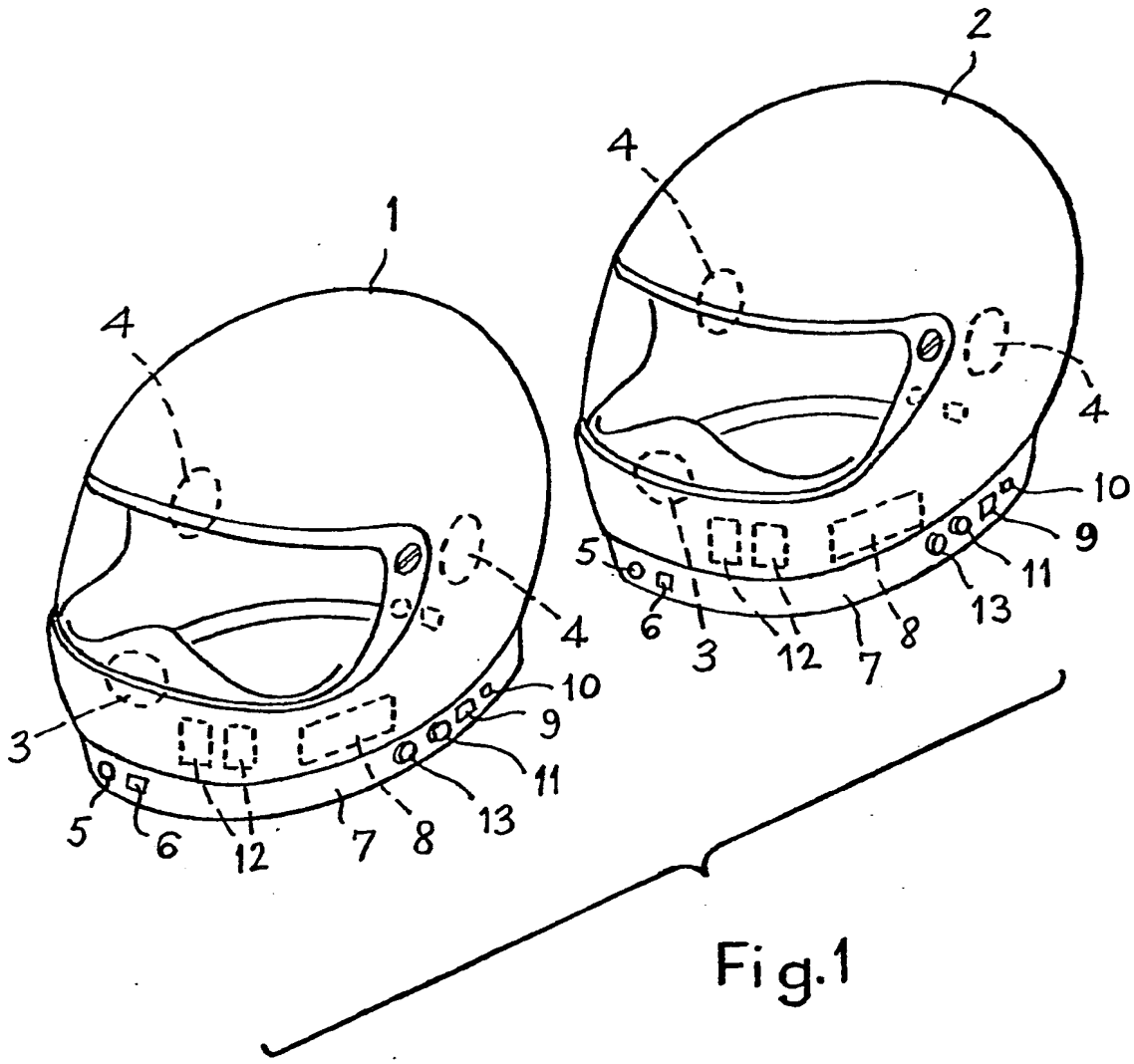

Fig.1

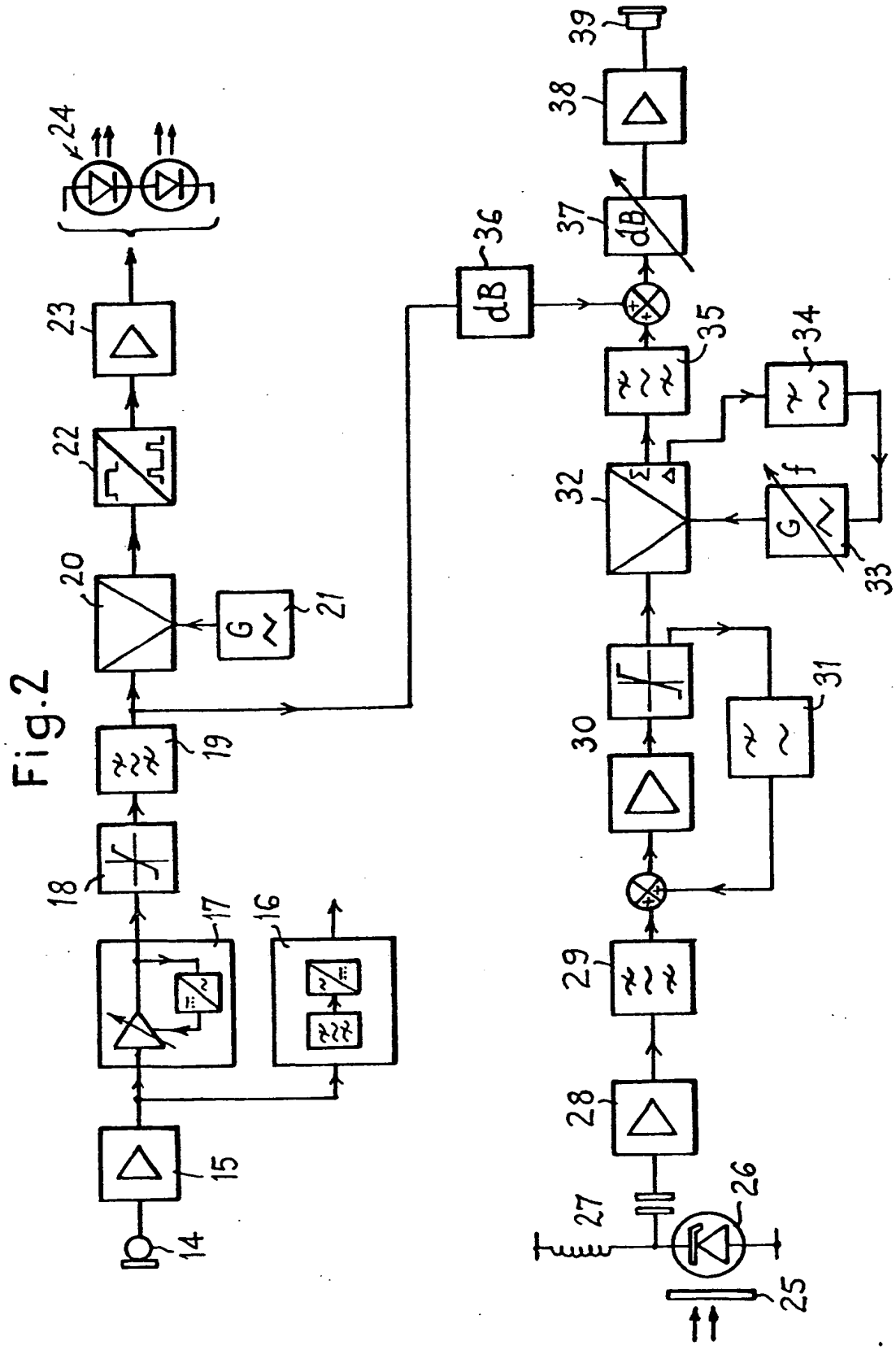
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Fig.2

SPECIFICATION

Communication systems for headgear

The present invention relates to communication systems for headgear and in particular to a conductorless communication system for helmets.

When helmets are worn by motorcyclists and their pillion passengers or alternatively by motor rally drivers, where it is necessary for legal or safety reasons to wear helmets, there is often a communication problem since the helmets, in order to be safe, must cover the ears of the wearers.

It has previously been proposed to fit helmets with radio sets, and also with communication devices whereby the helmet user can communicate with a person exterior to his vehicle by plugging a communication line into his helmet.

It is an object of the invention to provide a conductorless communication system for articles of headgear, particularly helmets, to enable a motorcycle rider and his pillion passenger or alternatively two rally drivers in a motor vehicle to be able to communicate with each other without the necessity for any interlinking wiring.

Accordingly, the invention consists in a conductorless communication system for headgear, comprising a transmitting unit that includes a microphone and a transducer arranged to emit a beam of electro-magnetic energy, means for modulating said beam from said transmitting transducer, a receiving unit that includes one or more loudspeakers or headphones and a transducer, and a powerpack for enegersing the necessary electronic circuitry, all contained within or on a fitting arranged for association with an article of headgear, and said receiving transducer being so arranged as to be capable of receiving a modulated beam of electro-magnetic energy transmitted from a similar transmitting transducer arranged in or on another article of headgear. The invention also consists in an article such as a helmet incorporating such a communication system.

Advantageously the fitting is constituted by a trim garniture incorporating means for securing it to either the inside of outside of an article of headgear.

From another aspect the invention consists in a trim garniture for an article of headgear, comprising a padded strip locating a powerpack, transmitting and receiving units and one or more operating circuit modules associated with said units. Means are preferably provided for attaching and removing said trim garniture to an article of headgear in an easy and rapid fashion so that it may be mounted thereon or removed therefrom at will. Furthermore the invention consists in an article of headgear such as a helmet incorporating such a trim garniture.

The invention also consists in a helmet or like article of headgear provided with means whereby the wearer thereof may communicate without interconnecting cords or wires with the wearer of a similarly equipped helmet, said helmet being provided with a transmitter and a receiver operable on the basis of modulated frequencies within the infra-red region of the electromagnetic spectum, the receiver and transmitter each having appropriate transducers located substantially adjacently the helmet, so that in use, the receiver transducer is capable of receiving signals broadcast by the transmitter transducer of a second similarly transducer-equipped helmet but with the transducers located on the respectively opposite side of the helmet.

In carrying the invention into effect the transmitting unit may be voice-operated.

In order that communication may be effective it is necessary to ensure that the communication system shall be able to overcome ambient noise and the arrangement must be economical since it is intended to be powered by direct current battery sources contained within the headgear.

From many points of view all these desiderata can be met by a comunication system based on modulated frequencies within the infra-red region of the electromagnetic spectrum and conveniently therefore the microphone of the transmitting unit is connected by a modulator to an LED emitting device arranged to emit a train of pulses. One convenient method of modulation is pulse-position modulation (PPM) so that in effect the speech passing through the microphone is transmitted in the form of a pulse-position modulated series of pulses.

Concommitantly the receiving transducer may comprise a photo-diode arrangement and for combatting the problems of noise avoidance such a device may be associated with a phase-lock loop detector.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings showing one particular embodiment thereof in which:

Figure 1 shows a pair of helmets located one behind the other as for use by a motorcycle driver and a pillion passenger and containing the necessary equipment for carrying out the invention, and

Figure 2 shows a block schematic diagram of a suitable transmitter-receiver for use with the helmets shown in Figure 1.

Referring now to the drawings, Figure 1 shows a pair of helmets 1 and 2 within each of which are arranged a microphone 3 on the inside of the chinguard and pairs of loudspeakers or headphones 4, one for each ear of the wearer.

On the outside of the helmets, there are arranged an infra-red emitter 5 in the form of an LED and an infra-red receiver in the form of a photo-diode 6 and set at the front and one set at the rear, held in position by a trim garniture 7 e.g. of padded leather and arranged to contain the necessary wiring and associated electronic devices This garniture may be provided with press-studs, touch-and-close fasteners or other means to enable rapid fitting to and removal from the helmets, but these may have not been shown, so as to simplify the drawings. However, they are so usual

as not to require illustration.

Also within each helmet is provided an electronic package 8 comprising the necessary decoding and modulating means for influencing the infra-red signals produced by the transmitting unit and the whole of the circuitry can be controlled by a switch 9 for forward or back transmit and an on/off switch 10. There may also be provided an input socket 11 for connection to external mains for recharging the batteries which are illustrated at 12. If desired a further socket may be mounted at 13 to act as an input socket for external devices such as radio, sound recorder, CB radio and so on. Internal wiring between these components has not been shown but will be apparent to those skilled in the art.

It will be appreciated that the configuration just described is suitable for the rider of a motorcycle and his pillion passenger and to this end the transmitting and receiving units are located fore and aft of the helmets and as depicted, the helmets are interchangeable since they include transmitting transducers and receiving transducers at both the front and back of the helmets.

In cases where the wearers of the helmets are seated side-by-side as in a motor vehicle for example, it will be apparent that the transducers will need to be placed on the sides of the helmets instead of at the back and front thereof.

It will also be clear that if interchangeability between the helmets is not required then the transducing devices can be reduced in number so that e.g. in the motorcycle configuration there is a transmitting transducer only at the rear of one helmet together with an associated receiving transducer and the other helmet would have its transducer devices at the front thereof. Similarly in a side-by-side configuration as for a motor vehicle one helmet need be provided only with transducing devices on its left-hand side and the other its right-hand side so as to reduce cost of the equipment.

All the devices are contained in or on the trim garnitures since it is envisaged that these would be made separately from the helmets *per se* and would be fitted to the latter subsequently.

The range of the transducers need not be very great as in use, the pair of helmets will be generally within one metre of each other but the units may be arranged to operate of a diverging area so as to enable communication to be effected even when the wearers are turning their heads.

The working mode may be half duplex i.e. both transmitters identical but only one can transmit at a time.

To mimimise current consumption due to outside sources e.g. bright sunlight, optical filters may be provided to remove most of the ambient radiation and allow only a narrow band around the LED wavelength to pass.

Figure 2 shows a block schematic drawing of a transmitter-receiver system for use with the invention as would be embodied in the elements 5 to 10 of Figure 1.

Both helmets are identically equipped. Transmissions are in the half duplex mode.

In this circuit diagram the transmitter section is shown in the upper part and the receiver in the lower part thereof. Signals are picked up by a speech microphone 14 and amplified by a preamplifier 15 and are then split into two paths. One path feeds a voice-operated switch 16 which enables the rest of the transmitter when the input signal reaches a defined level. The other path feeds an automatic gain adjusting circuit 17 which attempts to produce a constant signal level. The processed signal passes through an instantaneous limiter 18 that clips any transients that beat the ABC. A bandlimiting feature 19, typically operating between 300 and 3300 Hz, restricts the signal to a telephone type band, removing high frequency components that could cause a biasing and intermodulation distortions.

The audio signal is presented to one part of a PWM modulator 20. The other input is fed with a triangle 'carrier' wave generated by an oscillator 21 operating typically at a frequency of 20 KHz. The modulator 20 consists essentially of a voltage comparator that switches whenever the triangle wave exceeds the instantaneous audio voltage. To minimise distortion of the recovered signal the triangle wave must be linear and symmetrical.

The double-edged pulse width modulated signal is converted to pulse position modulation by circuit 22 which generates a narrow, constant width pulse at each transition of its input. Double-edged modulation means that both leading and trailing edges of the pulse are modulated with respect to a specific phase reference. The use of PPM rather than PWM allows the average transmittal power to be greatly reduced for a given peak power.

The PPM pulse train is applied via a driven amplifier 23, to transmitter LED's 24 passing typically a wavelength of 940 nm the amplifier 23 maintaining a constant current drive level against changes in battery voltage and ambient temperature. Suitable LED's are Siemens Type LD 241.

In the receiver section shown at the lower part of the drawing, the received radiation passes through an optical bandpass filter 25 and illuminates a fast photodiode 26. Suitable photodiodes are type BPW 34. The optical filter minimises the effect of ambient illumination and the associated wideband shot noise. The photocurrent output is fed to a simple LC band dividing filter 27. DC and low frequency components are shunted to ground through the inductor. The wanted high frequency signal passes through the capacitor into a trans-impedance amplifier 28. The signal is bandlimited and phase connected in a filter 29 operating typically over a frequency of 10—600 KHz to maximise the peak signal-to-noise ratio and presented to a limiting amplifier 30. DC feedback through an LDF 31 optimises the slicing threshold against the noise — ideally to give equal probability to 'false alarms' as to missed pulses. The output of the

limiting amplifier is a pulse train similar to that produced by the PWN-PPM converter 22 in the transmitter section.

A PPM demodulator 32 uses the pulse train to sample a locally generated triangle wave from an oscillator 33 that is phase locked to the one in the transmitter. The sampling is done by two separate circuits — one works on the positive slope of the triangle wave, the other on the negative slope. The sum and difference of these two samples is taken. The difference voltage corresponds to the phase error between the local oscillator 33 and the one in the transmitter, and is fed through a low-pass 34 to control the frequency/phase of the local oscillator 33 thus closing the phase lock loop.

The sum voltage is the recovered audio signal which is filtered in a filter 35 typically operating at 300—3300 Hz to remove unwanted carrier, harmonics and intermodulation products. The received audio signal is mixed with a side tone feed 36 and fed via a user volume control 37 and output amplifier 38 to an earpiece or loudspeaker 39.

It will be apparent that the invention has been described only by way of example and that various modifications may be made to the specific details referred to without in any way departing from its scope. E.g. the modulation could be other than PPM for example frequency modulation in which case the transmitter could be a voltage-controlled oscillator driven by amplified audio and followed by an output stage and the LED's. The receiver may comprise the photo-diode followed by a buffer amplifier with band limiting.

Furthermore, the enabling circuitry, instead of being built into a trim garniture for fitting to the inside of the outside of a helmet, could be installed in a pocket-pack plugging into the helmet with a short light-weight cord, or be fitted to a satchel or bandolier worn by the user.

CLAIMS

1. A conductorless communicator system for headgear, comprising a transmitting unit that includes a microphone and a transducer arranged to emit a beam of electro-magnetic energy, means for modulating said beam from said transmitting transducer, a receiving unit that includes one or more loudspeakers or headphones and a transducer, and a powerpack for energising the necessary electronic circuitry, all contained within or on a fitting arranged for association with an article of headgear, and said receiving transducer being so arranged as to be capable of receiving a modulated beam of electro-magnetic energy transmitted from a similiar transmitting transducer arranged in or on another article of headgear.

2. A system as claimed in claim 1, wherein the fitting is constituted by a trim garniture incorporating means for securing it to an article of headgear.

3. A communication system as claimed in claim 1 or 2, wherein the transmitting unit is voice-operated.

4. A communication system as claimed in claim 1, 2 or 3 which is arranged substantially to overcome ambient noise.

5. A communication system as claimed in any of the preceding claims which is powered by direct current battery sources also arranged for location in the article of headgear.

6. A communication system as claimed in any of the preceding claims which is based on modulated frequencies within the infra-red region of the electromagnetic spectrum.

7. A communication system substantially as hereinbefore described with reference to the accompanying drawings.

8. An article of headgear whenever incorporating a communication system as claimed in any of the preceding claims.

9. A trim garniture for an article of headgear comprising a padded strip locating a power pack, transmitting and receiving units and one or more operating circuit modules, all being parts of a communication system as claimed in any of claims 1 to 7.

10. A trim garniture as claimed in claim 9, provided with means for attaching and removing said garniture to an article of headgear in an easy and rapid fashion.

11. An article of headgear whenever incorporating a trim garniture as claimed in claim 9 or 10.

12. A helment or like article of headgear provided with means whereby the wearer thereof may communicate without interconnecting cords or wires with the wearer of a similarly equipped helmet, said helmet being provided with a transmitter and a receiver operable on the basis of modulated frequencies within the infra-red region of the electromagnetic spectrum, the receiver and transmitter each having appropriate transducers located substantially adjacently in the helmet, so that in use, the receiver transducer is capable of receiving signals broadcast by the transmitter transducer of a second similarly transducer-equipped helmet with the transducers located on the respectively opposite side of the helmet.

13. An article of headgear substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

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